# ORGANIC SYNTHESIS AND MECHANISM.

# APPLICATIONS OF CHEMISTRY IN BIOLOGY AND MEDICINE.

# THE PEDAGOGY AND HISTORY OF ORGANIC CHEMISTRY.

## COLLECTED WORKS, 1977-2011

A thesis submitted for the degree of
Doctor of Science in the Faculty of Sciences

University of Adelaide

by

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**Part II: Patents**

# SUMMARY STATEMENT SUPPORTING THE CLAIM FOR THE DEGREE OF DOCTOR OF SCIENCE

This thesis contains 63 published papers, reviews and book chapters, and 18 U.S. and Australian patents, which constitute the major part of my work for the period 1977-2011. These works encompass contributions in four major areas of organic chemistry: 1) physical organic chemistry and applied organic chemistry, consisting of 13 published works during the period 1977-1998; 2) synthetic organic chemistry, natural products chemistry, and medicinal chemistry, consisting of 27 published works during the period 1979-2010; 3) the pedagogy and history of chemistry, consisting of 13 works during the period 1994-2011; and 4) laser tissue welding and photobiological applications of organic chemistry, consisting of 9 published works during the period 1993-1998. The patents cover two major areas: 1) 10 patents granted during the period 1993-2009, describing the applications of 4-amino-1,8-naphthalimide derivatives in analysis, photobiology and medicine; and 2) 8 patents granted during the period 2002-2008, describing the preparation and uses of acid-based antimicrobial materials.

The works presented in physical organic chemistry include a highly cited book chapter, and a computer program for the calculation of isotope effects, based on a simple valence force field. Despite advances in both computer speed and memory size, this program has been used to model transition states in enzymatic reactions for over three decades; today, those models are then used as input into more sophisticated computations.

Synthetic organic chemistry has been the major part of my independent career, and comprises the major part of my works. The works presented have been cited an average of 6 times each (excluding self-citations), with approximately half being cited 10 or more times. My initial work was in the synthesis of polycyclopentanoid compounds, which led to the discovery of a useful intramolecular cyclization of epoxypropiolate esters with Lipshutz "higher order" cuprate reagents. In the 1990s, I began a collaboration that led to the first synthesis of the 3-bromo-4-alkylamino-*N*-alkyl-1,8-naphthalimides and showed their potential as photochemically-activated antiviral compounds; hydrophilic versions are used in laser tissue welding. The latter dyes are now in Phase I human trials. Our most recent work has a new focus on the development of new oral anticoagulants; our first paper is part of this submission.

My work in the History of Chemistry has resulted in 9 published papers and one book chapter. In my 1994 papers on the rise of chemistry at Kazan; University, in Russia, I coined the phrase, "cradle of Russian organic chemistry." This phrase has been adopted by Kazan' State University as an unofficial slogan, is used on their official web site, and appears in their publications. The 1994 papers have been scanned posted on the Kazan' State University web site. My work in pedagogy has led to 5 publications in the *Journal of Chemical Education*, one of which has been cited 16 times since its publication.